ROYAL ASTRONOMICAL SOCIETY.

Vol. II. *February* 11, 1831. No. 2.

Report of the Council to the Eleventh Annual General Meeting of the Society.

In meeting the Members of this Society, at their Eleventh Anniversary, the first topic of congratulation which the Council have to offer, is the change of style and name. The intimate connexion which exists between the objects of our association, and the honour and safety of the British Navy, has not escaped the attention of his Majesty. The countenance shewn to us by the Duke of Clarence, as Lord High Admiral, has been continued and confirmed by William the Fourth: and we are now assembled as the *Royal Astronomical Society*, with the Sovereign as our *Patron*.

Another important alteration in the condition of our body is on the eve of taking place, and, but for some technical delays, would have been this day announced as completed; viz. the obtaining a charter, and thus commencing an existence more immediately recognised by the laws. The motives for this proceeding have been already submitted to you, and have received your approbation and liberal support. It was generally felt that the Astronomical Society, from the consideration with which it was treated by men of science at home and abroad, by other kindred bodies, and by the Government, owed this mark of deference to opinion and to custom; and, in order to secure the possession of the property which we had acquired, or might be expected to acquire, from the liberality of our members, and to insure the appropriation of that property to the specific uses for which it was destined, it was necessary that we should no longer remain an irresponsible and unauthorised company of individuals. It has, however, been the careful endeavour of the Council to avoid any extension of the powers committed to themselves or to their successors, and not to cripple, by unnecessary limitations and directions, the operations of the future. Their objects have been to secure the property, perpetuate the existence, and augment the consideration of the Society, but in all other respects to leave the constitution untouched; and, above all, to continue the full exercise of power in the only proper guardians,—the body of the members at large. When the charter shall have received the sign manual, an altered and amended code of bye-laws will be proposed for your consideration. A few modifications have been suggested by experience, but they are neither extensive nor

numerous; so that we may look forward with a reasonable expectation of harmony and usefulness, warranted by the experience of the past. One alteration, for discontinuing in future the election of *non-resident* members, will be proposed to you to-day;* and the charter itself will be read for your consideration and approval.

The Report of the Auditors as to the receipt, expenditure, and present state of the Society, is as follows; viz.

Receipts.	£.	s.	d.
Balance of last year.....	286	2	5
Arrears, Feb. 1830 :—			
Resident members	25	9	0
Non-resident members	16	16	0
Contributions for 1830-1 :—			
8 admission fees	16	16	0
67 resident members (64 at 2 guineas, 3 at 1).....	137	11	0
8 non-resident members ...	33	12	0
4 compositions	84	0	0
Sale of memoirs	57	0	0
Arrears of ditto, Messrs. Baldwin and Co.	62	8	0
Sundries per Mr. Haggard and Mr. Maclear	1	6	0
	£721	0	5

Expenditure.	£.	s.	d.
3 gold medals and engraving	30	17	6
Engraving plates.....	8	18	6
1 year's rent to Michaelmas	52	10	0
Fenner, 2 bills for printing plates	13	11	8
Harrison, for stamps and stationery	16	7	10
Ditto, for commission	17	3	0
Sundry disbursements for porterage, postage, freight of foreign books, &c. &c.	37	18	3
Balance in the hands of the Treasurer, Feb. 1831 ...	543	13	8
	£721	0	5

Assets of the Society.

		£.	s.	d.
Balance in the hands of the Treasurer		543	13	8
Arrears, Feb. 1831 :—				
4 contributions of four years' standing	£33 12 0			
4 ——— of three ditto	25 4 0			
7 ——— of two ditto	29 8 0	140	14	0
16 ——— for the past year	35 14 0			
2 ——— non-resident	16 16 0			
New Members :—				
6 contributions at 3 guineas	18 18 0			
1 ——— at 4 ditto	4 4 0	48	6	0
3 ——— non-resident	25 4 0			
1 year's dividend on £800 consols, due January 1831.....		24	0	0
½ ——— on £857 13*s.* 8*d.* 4 per cents, July 1830		17	3	0
½ ——— on ditto, now 3½ ditto, January 1831		15	1	0
The said stock, valued at about		1500	0	0
Various astronomical instruments, books, prints, &c. &c.				
15 silver medals, unappropriated.				

Abstract of the present state of the Society, as regards its Members :—

	Members.		Associates.
February 1830	243	.....	34
Elected since	22	.....	7
	265		
Died 5	7		
Resigned 2			
Totals	258	.....	41

* This proposal was unanimously adopted by the Meeting.

Patron	1
Compounded	45
Annual contributors	101
Non-resident	110
Honorary	1
	258

Amongst the losses which the Society has sustained by death, it is with particular regret we notice the decease of Commander Thomas Boteler, R.N. and of Mr. Tulley, the optician.

Commander Boteler was actively employed in surveying the western coast of Africa in H.M.S. Hecla, when he fell a sacrifice to the noxious climate of that fatal country. Few young men have distinguished themselves more in the scientific branches of his profession; and none ever pursued the important duties on which he was engaged with more disinterested and uncalculating ardour.

The skill of Mr. Tulley, as a practical optician, is too well known by every person present to demand any lengthened notice here. By long and careful experience, he had acquired a knowledge and tact which has never perhaps been surpassed in the construction of achromatic telescopes. In later times, it is true that large object-glasses have been worked with more success upon the Continent than in England: but it must be acknowledged that this superiority has been entirely owing to the greater excellence of the material. It is grievously to be lamented that much of the labour of this invaluable artist was absolutely wasted, from the impossibility of procuring flint glass capable of forming an object-glass at all; lens after lens having been rejected by him before one could be found of requisite purity, even of moderate aperture: while the splendid refractors which he constructed from *foreign* discs, within these few years, shewed that the difficulties lay, not in the artist's want of skill, but in the intractable and variable nature of his materials. It is pleasing to add, that Mr. Tulley maintained through life a character of great simplicity and unsullied probity.

The most prominent subject of public interest, (and one that has engaged much of the attention of your Council during the past year,) was the proposing an amended form of the *Nautical Almanac*. The Lords Commissioners of the Admiralty, being desirous that the National Ephemeris should be remodelled, so as to meet the increasing wants and intelligence of the navy, and also the demands of astronomers, referred the consideration of the subject to the Council of the Astronomical Society. A Committee was formed, with the co-operation of the most distinguished navigators and astronomers of the empire, and an elaborate Report drawn up, recommending various alterations and additions. This has been approved of by the proper authorities; and the *Nautical Almanac* of 1834 will appear in strict conformity with the plan advised.

The most important *alteration* is the substitution of *mean* for apparent solar time in all the data of the Ephemeris. It was with considerable reluctance, and after viewing the subject in every light, that the Committee resolved upon this material departure from the

mode adopted by Maskelyne, and rendered familiar by the practice of more than half a century; but, as chronometers are to be found in perhaps every ship which relies upon astronomical means for her guidance, and as mean time must necessarily be obtained where chronometers are used, it was deemed safer to dismiss apparent solar time altogether as unnecessary, and as being a source of confusion. The advantages, as to simplicity, of exchanging a varying for a constant measure of duration, and of assimilating the computations of the navigator and of the astronomer, are too obvious to be dwelt upon; and, in the opinion of all the naval officers present, no serious or lasting inconvenience from the change is likely to be felt.

The chief *additions* to the nautical part of the Ephemeris are, the right ascension and declination of the moon for every hour, the right ascension and declination of the bright planets for each day, and their distances from the moon for every three hours: additions, of which it will not be too much to say, that they more than double the facilities at present possessed for determining with accuracy the longitude and latitude at sea or on land.

For Astronomy, besides that which she enjoys in common with Navigation, we shall have all the data and minuteness, with the accuracy, of the most improved tables; the minor planets, an increased list of standard stars with their apparent places, and numerous other subjects of interest, which will be best learned from the Appendix to the Report inserted in the preface to the *Nautical Almanac* of 1833. Indeed, we may confidently hope that the extended *Nautical Almanac and Astronomical Ephemeris* will form an era in the progress of our science. The Report to the Lords Commissioners of the Admiralty, which embodies the grounds for each alteration, will, by the permission of their Lordships, appear in the Memoirs.

It has further been thought advisable by the Government to alter the constitution of the Board of Visitors to the Royal Observatory. The Presidents of the Royal Society and of this Society were respectively empowered to nominate five persons, and to form with these, and with the Savilian Professor of Oxford and Plumian Professor of Cambridge, a Board of visitation for our national observatory. A warrant with the necessary powers has been issued; and deliberations have already been held upon points of considerable importance.

Upon another very interesting topic, this Society, in conjunction with the Royal Society, has been applied to by the Government for their counsel; viz. as to the utility of supporting two observatories in the southern hemisphere. On a former occasion the Council gave an opinion in the affirmative; and a second deliberation has only strengthened the sentiments previously expressed. The observatory at the Cape is of the highest class, furnished with the best instruments which art can produce, and directed by an astronomer whose zeal and fidelity correspond to his information and his talents; whilst the Paramatta Observatory, founded and fostered by the provident munificence of Sir Thomas Brisbane, is required to fix

the geographical points of a growing empire — to facilitate terrestrial and maritime surveys — to act as a useful aid as well as check upon the meridian observations of her southern sister — and, favoured by its remarkable position as well as by a sky of unusual purity, to embrace a numerous and valuable class of phenomena not visible elsewhere. Your Council feel assured that their representations, and those of the Royal Society, will not be made in vain.

It is with great regret that your Council announces the retirement of Dr. Pearson (one of the earliest, steadiest, and warmest supporters of the Society) from the office of Treasurer. They have also to regret that the exertions, which Lieut. Stratford, R.N., has hitherto most unsparingly bestowed upon your affairs, have been found to trespass so deeply upon his time, as to interfere with other avocations, and oblige him to resign the Secretaryship. Feeling the impossibility of replacing this loss, and aware of the laborious and irksome nature of the duties which have been, up to this time, attached to the office, the Council were of opinion that an Assistant should be appointed with a salary, and thus render the duties less onerous to Mr. Stratford's successor; and they have accordingly chosen an Assistant Secretary, at a salary of £100 a-year. The Council must here gratefully acknowledge the very handsome offer of Lieutenant P. Lecount, R.N. to undertake Mr. Stratford's duties, after that gentleman's resignation; but the arrangement already mentioned has made such a sacrifice on his part unnecessary.

Little more would appear to be required for the complete establishment and comfort of the Society than a local habitation, where the members might enjoy the advantages of mutual intercourse, of their valuable library, and of their instruments. That we should meet in a house of our own is so essential to the objects of our association, and so imperiously called for by the position in which we stand, that we reasonably look for a speedy realisation of this hope, either from the care of Government, or from the liberality of our own body.

To our stock of instruments, Dr. Lee has added a divided circle, for shewing the mean time corresponding to a given sidereal time, and *versâ vice*; and Mr. Wollaston, a wire micrometer belonging to the telescope presented by his illustrious uncle.

To the library many valuable contributions have been made, amongst which may be particularly noticed the first volume of a Translation of the *Mécanique Céleste*, with notes, by one of our associates, Mr. Bowditch of New York; and Tables (*Tabulæ Regiomontanæ*) for facilitating astronomical reductions by another associate, the indefatigable Bessel.

The *Mécanique Céleste*, the mighty storehouse from which the geometers of the present generation have drawn the chief materials of their laborious speculations, is so abstruse and concise as to have obtained but a very limited number of readers, even in those countries where analysis is most successfully cultivated. Mr. Bowditch's work is designed to smooth the difficulties, and fill up the chasms, impassable to ordinary capacities; and thus

to bring physical astronomy, the ultimate object of practical astronomy, within the grasp of a larger circle of cultivators. We esteem this wise and spirited application of Mr. Bowditch's talents; and we hail it as a favourable augury of the future promise of his active and intelligent country.

The *Tabulæ Regiomontanæ* is another of those landmarks, ascertaining and securing the progress of astronomy, for which we are indebted to the author of the *Fundamenta Astronomiæ*. Before we can safely compare the theory of gravitation with the observed motions of the heavenly bodies, it is necessary to eliminate, as far as is possible, the uncertainties which might vitiate the process; and, for this purpose, the uniform practice of all good practical astronomers has been to determine, by repeated observations, a few fixed fundamental points, and, by a comparison with these, settle the place of every other body. Thus, the thirty-six stars of the Greenwich catalogue has formed for many years the groundwork of most meridian observations. In the present work, Professor Bessel has given tables by which the apparent place of each of these standard stars, and of the two pole-stars, may be readily found for every day from 1750 to 1850; depending upon the observations of Bradley and those of Professor Bessel himself. When, by these aids, the solar, lunar, and planetary observations have been reduced, it will be seen how nearly the theory of gravitation, and the tables which are founded upon it, represent the system of nature. The volume also contains other very important and useful tables, with the necessary explanations: and it is an additional advantage, that an universal language (the Latin) is used as the vehicle of communication.

In the printed Report of last year it was mentioned that a standard scale had been ordered by the Society, and that Messrs. Troughton and Simms had undertaken to execute it. Little progress has as yet been made, partly from the previous engagements of the artists, and partly from the consideration and caution required for the construction of so important an instrument: for, no sooner had your Council expressed an intention of authorising a standard unit of length, than the most flattering applications were made by Professors Schumacher and Struve, for verified copies on behalf of their respective governments. The Council have reason to believe that the standard measure which they may propose and execute will be adopted by the accomplished officers who conduct the Indian and Irish surveys. Lieut. Drummond, R.E. has offered his services for examining and verifying the divisions of the original scale; and this delicate and troublesome task will be gladly placed in such experienced hands.

Observations of the Right Ascension of Venus, for the purpose of determining the Mass of the Moon, in the manner pointed out by Professor Airy, and recommended by the Council, have been received from Dr. Robinson, and from Professors Bianchi, Nicolai, Santini, and Schwerd. More communications of the same nature will probably arrive; and it is hoped that, from a combination of

many excellent observations, Mr. Airy will be able to determine, with great exactness, this very important, and as yet uncertain element. Many valuable observations of Occultations have been communicated, from time to time, by public and private observers, which will appear, in a synoptical form, in the fourth volume of the Transactions. The lists of predicted occultations, to which we are mainly indebted for this plentiful harvest, have been computed in part by Lieut. Stratford, but chiefly by Mr. Henderson, who has thus acquired fresh claims to the gratitude of practical astronomers.

From Capt. Smyth we have received a very valuable collection of occultations, and of eclipses of Jupiter's satellites; with an interesting description of the observatory recently built by him at Bedford, and a determination of the latitude of the observatory by the *Lee Circle*, the zenith point being derived from the *Vertical Floating Collimator*. It is to be wished that we may be favoured, by other observers, with similar information, as it is only by repeated trials that the simplest and most effectual mode of pursuing astronomical inquiry can be discovered. Mr. Maclear has also presented a similar list of occultations, as observed by the *Wollaston telescope*, accompanied by a full and satisfactory description of the means employed by him for ascertaining the time. It would seem that entire confidence may be placed upon the observations of this gentleman and of Capt. Smyth; and the relative longitudes of Greenwich, Biggleswade, and Bedford, deduced by Mr. Henderson from corresponding observations, are almost as accordant as could be desired. From Mr. Ward, to whom the *Beaufoy Circle and Clock* are intrusted, no communication has yet been received, which may naturally be attributed to the short time they have been in his possession; a period (when the time unavoidably occupied in erecting and adjusting astronomical instruments is considered) insufficient for the completing a series of observations of moment.

The *Beaufoy Transit and Clock* have been returned by Capt. Smyth, and are now at the disposal of the Council, to be lent, agreeably to the rules laid down by the Council for that purpose, to such members as may be desirous of making observations with them.

Three comets have been discovered in the course of the last year; the first by Mr. Gambart, at Marseilles, who gave immediate information of it throughout Europe. We have received observations of this comet from Professors Santini and Nicolai, who have severally deduced the elements of its orbit, and from the President. The second was seen and observed near the South Pole, by Professor Dabadie (who also computed its orbit), and by Capt. King. And the third was recently discovered by Mr. Herapath. The observations and orbit of the comet of Gambart will appear in the Transactions, vol. iv. part 2, which will speedily be published. Part 1 has been for some months before the public.

The Council has this year awarded two of its gold medals; one to Capt. H. Kater, for the invention of the *vertical floating col-*

limator; and the other to M. Damoiseau, for his Memoir upon the Theory of the Moon and for his Lunar Tables.

The inconvenience and, in some instances, the uncertainties to which the plumb-line is subject, and the instability of spirit levels, have long tormented and perplexed the practical astronomer, while observations by reflection, which have recently been much used, are, though unobjectionable where applicable, necessarily limited in practice to favourable situations. The vertical floating collimator enables us to ascertain the zenith point with more ease, and probably with greater accuracy, than either the level or plumb-line; and is expected scarcely to yield in exactness to observations by reflection; while it is undoubtedly of more universal and easy application. In one important respect (that of obtaining a complete result without altering the principal instrument) the collimator is invaluable.

The motion of the moon has engaged the attention of astronomers from the earliest ages; and has justly been considered, from the paramount utility of the object, as well as the difficulties of every kind which envelope the research, the most sublime branch of astronomy. M. Damoiseau, in his elaborate treatise, has carried his approximations beyond any former mathematician; and that with a detail and clearness which are the best guarantees of truth. The magnitude of the labour, the analytical skill of the geometer, the accuracy of the results, and the great perspicuity with which they are exhibited, have particularly fixed the attention of the Council; and have been the powerful motives for awarding the other gold medal to this distinguished mathematician.

Such is the Report of the proceedings of the past year, which the Council have the pleasure of presenting to the Society. For a more detailed notice of the memoirs communicated, they refer to the Abstracts, which are published every month, and distributed to such of the Members as may wish to possess them. The Council have the satisfaction of reflecting that, so far as in them lay, they have not been wanting to the honour and interest of the Society, or to the advancement and general diffusion of the science. By persevering in the same course, we must increase the power and usefulness of our union in every succeeding year; and we may reasonably hope that the progress of astronomy, geography, and navigation, may, for ages yet to come, be advanced and consolidated by the activity, harmony, and intelligence of the *Royal Astronomical Society.*

Titles of the Papers read before the Society, between February 1830 *and February* 1831.

March 12, 1830. On Mr. Pond's recent Catalogue of 720 Stars. By Francis Baily, Esq.

Extract of a Letter from Professor Harding to Dr. Tiarks, on the Occultation of Aldebaran, observed at Gottingen December 9, 1829.

On the Method of Computing the Longitude from an observed Occultation. By Edward Riddle, Esq.

April 7. Observations of the Planets made at the Imperial Observatory of Vienna, in 1828. By Prof. Littrow.

Observations of Occultations of Stars by the Moon, at Mr. South's Observatory, at Kensington.

Extract of a Letter from Charles Perkins, Esq. to the President, on the Observation of two Occultations, on the 28th March.

On the Method of ascertaining any Inaccuracy in the Pivots of Transit Instruments, &c. By Lieut. P. Lecount.

Fourth Series of Observations with a 20-feet Reflector, containing the mean places and other particulars of 1236 Double Stars. By J. F. W. Herschel, Esq.

May 17. On an appearance of Divisions in the exterior Ring of Saturn. By Capt. Kater.

Occultations observed at Biggleswade with the Society's Wollaston Telescope. By T. Maclear, Esq.

On the Comet discovered at Marseilles in the Constellation Equuleus. By the President.

Notice of the Performance of the 20-feet Achromatic. By the President.

June 11. Observations and Remarks made on a Passage from New South Wales to England. By C. Rumker, Esq.

A Letter from Lieut. Hartmann to J. F. W. Herschel, Esq. describing an Instrument constructed for him by M. Hohnbaum, of Hanover.

On the Rectification and Use of the Equatorial. By M. Kreil.

On Mr. Barlow's New Telescopes. By Professor Littrow.

A Letter by Mr. Hubert to the President, on the effect of Magnetic Attraction on Pendulum Experiments.

On Mayer's celebrated Catalogue of Zodiacal Stars. By Francis Baily, Esq.

A Paper from Dr. Robinson, of Armagh, containing the results of his Observation of Venus, for the purpose of determining thereby the Mass of the Moon, as proposed by Professor Airy.

Two Memoirs, by Don José Joachim de Ferrer, containing Observations made at the Havannah, from 1808 to 1812, with the resulting longitude and latitude of that city.

November 12. Ephemeris of the Occultations of α Tauri in 1831, for ten European Observatories. By Mr. Maclear.

Practical Rules for the approximate Prediction of Occultations. By Mr. Henderson.

A Note by Mr. Gompertz, to a paper by M. Kreil, on the Rectification of the Equatorial.

Occultations observed at Boston, Massachusetts. By Mr. Robert Treat Paine.

Observations upon the period of the variable Star β Lyræ. By Mr. W. R. Birt.

Two Papers on Terrestrial Refraction. By the late Mr. Henry Atkinson.

December 10. On the Method of determining the Declinations of Stars with one mural circle. By J. Pond, Esq. A.R.

A Letter from Capt. P. King, R.N. on a Comet seen near the South Pole.

A Letter from Sir Thomas Brisbane, with Occultations of Fixed Stars by the Moon, observed at Makerstown.

An Account of a Private Observatory recently erected at Bedford. By Capt. Smyth.

January 14, 1831. On the Computation of observed Occultations. By Mr. Maclear.

Observations of the Right Ascension of Venus, to determine the Mass of the Moon, (as recommended by Professor Airy). By Professor Nicolai.

Observations of the Right Ascension of Venus, about her inferior Conjunction. By Professor Santini.

A Letter from Professor Bianchi, of Modena, containing Observations of the Right Ascension of Venus, in order to determine the Mass of the Moon.

Occultations of the Stars and Planets observed at Dorpat. By Professor Struve.

Two Notes on the Comet of Halley. By Mr. Lubbock.

A Letter from Mr. Herapath to the President, announcing the discovery of a Comet.

List of Public Institutions, and of Persons, who have contributed to the Society's Library, Collection of Instruments, &c. since the last Anniversary.

Agricultural and Horticultural Society of India.
American Philosophical Society.
Cambridge Philosophical Society.
East India Company.
Geological Society of London.
Italian Society at Modena.
L'Académie des Sciences de Dijon.
London Institution.
Le Bureau des Longitudes.
Linnæan Society.
Literary and Historical Society of Quebec.
Royal Society.
Royal Institution.
Royal Asiatic Society.

Society of Arts.
Society for the Diffusion of Useful Knowledge.
University of Oxford.

Professor Airy.
John Avdale, Esq.
Charles Babbage, Esq.
Francis Baily, Esq.
Professor Bessel.
Professor Bowditch.
M. Cacciatore.
Professor Carlini.
M. Cerquero.
Dr. Civiale.
Rev. H. Coddington.
Professor De Morgan.
Editor of Bibliothèque Universelle.
Professor Encke.
M. Faraday, Esq.
M. Francœur.
Professor Gautier.
Robert Goodacre, Esq.
W. D. Haggard, Esq.
Professor Hamilton.
Professor Hassler.
J. F. W. Herschel, Esq.
Lieut. P. Lecount.
Dr. Lee.
A. A. Lindo, Esq.
Professor Littrow.
Sir Richard Phillips.
M. Plana.
Professor Quetelet.
Dr. Robinson.
Professor Sammering.
Professor Schumacher.
Professor Struve.
Richard Taylor, Esq.
Dr. Tiarks.
B. L. Vulliamy, Esq.
M. Weisse.
Alex. Wollaston, Esq.

*** *The titles and subjects of these presents are more fully described in the Memoirs.*

(*The President then addressed the Meeting on the subject of the award of the Medals, as follows:—*)

Gentlemen,—Practical Astronomy, although it had occupied the attention of philosophers from the earliest ages, made but little progress towards accuracy till the commencement of the seventeenth century. With an instrument, the invention of his own genius, and the work of his own hands, for Galileo was reserved the glory of discovering the satellites of Jupiter—the spots on the sun—the irregularities of the moon's surface—the phases of Venus—the singular appearance of Saturn—and the construction of the milky way.

He demonstrated that the planets moved round the sun—that the sun revolved on his axis—that the satellites of Jupiter were eclipsed by falling into his shadow—and that their immersion into, or emersion from it, might be employed for determining the longitude.

Notwithstanding the means which the telescope presented for determining with unexampled accuracy the positions of the heavenly bodies, more than half a century elapsed before it was generally applied to angular astronomical instruments; and it would be per-

haps difficult to select a more remarkable specimen of the baneful influence of prejudice, than that afforded by Hevelius, who, seventy years after the discovery of the telescope, exerted his great talents to support, by formal discussion with Hook, the superiority of plain over telescopic sights.

The improvement of the nonius by Vernier, and the invention of the pendulum clock by Huygens, formed the next era in practical astronomy: the former led to the construction of the quadrant as used by Flamsteed—the latter to that of the transit instrument, as employed first by Roemer; and subsequently by Halley* at the Royal Observatory.

The zenith sector of Hook, perfected by Graham,† conducted Bradley to the discovery of aberration and nutation; whilst the accuracy of large angular instruments by Bird, laid that foundation for modern astronomy upon which its present superstructure has been built.

But although British engineering had brought the mechanism of astronomical instruments to very considerable perfection, little had been done for the improvement of the telescope. Its unwieldy length compared with its aperture—the impracticability of using with it magnifying powers commensurate with the mechanical capabilities of the instruments, remained nearly as in the days of Galileo —till, in 1758, the discovery of the achromatic object-glass by Dollond gave a fresh impulse to astronomical inquiry; and the quadrant, which had long been the standard instrument for the determination of polar distances, became supplanted by the circle.‡ Astronomy gained much, and would have gained more by the change, had not the popular artist of that day§ forsaken the principles of his predecessors, and given to his circles azimuthal motion.

But amongst the founders of this Society we see the individual who, possessing the inventive genius of Graham, with the patient industry of Bird, has brought the fixed instruments of our observatories to such a degree of perfection, that little seems left for his successors to achieve. Having studied Troughton's mural circle, who can doubt its capability of leading us to truth, and that by the readiest means possible? Who that sees his transit instrument reversed again and again, yet retaining rigorously its meridian and horizontal positions—that sees it when distant many minutes of a degree from the meridian, fixed in it by a single sidereal observation, with nearly as much facility as an ordinary telescope is pointed to a star—who that sees it keeping its adjustments, not only for days and weeks, but even for months and years, can quit it without revering him who made it? Yet, notwithstanding the one retains its index error, and the other its meridian and horizontal adjustments, in a manner which to be believed must be witnessed,—

* Halley's transit instrument is still preserved at Greenwich.

† This instrument is also preserved at Greenwich.

‡ The Observatory at Oxford (as far as I know) is the only establishment where the quadrant is still in use.

§ Ramsden.

terrestrial points of reference, even to *them*, are highly useful. Thus, the bar of a distant window may be used for the one, or the luminous opening between two contiguous chimney-pots, seen in the horizon, may prove a wholesome verification to the other. Hence, in the establishment of an observatory, one of our first wishes is to command an uninterrupted view of the horizon in the direction of the meridian, for the erection of suitable objects, by observing which any alteration in the instrument's position can immediately be detected.

But as this necessarily involves control over a space of land which it falls to the lot of few to command; and as it frequently happens that, from atmospheric obstacles, the marks thus placed cannot be distinguished, any contrivance which can obviate these difficulties becomes desirable; hence it was that, about fifty years ago, the distant meridian mark of Rittenhouse's instrument having been rendered useless by interposed buildings, he happily availed himself of the fact, that rays issuing from the sidereal focus of the object-glass of one telescope fall parallel on the object-glass of another:* thus the cross wires of one telescope became a meridian mark to the other.

That means so simple, yet so adequate to perform the offices of distant marks, should have remained neglected till resumed by Captain Kater, is indeed surprising. Aware of the trouble in employing plumb-lines for the determination of the zenith point of circular instruments — having found, by experience, the perplexing instabilities of the spirit level — knowing that, in instruments moving in azimuth, constant reference to the one or the other is not only necessary, but indispensable, — he saw that the decussation of the wires in the sidereal focus of one telescope might be made to represent the horizon of another, all that was required being to float the former telescope on the surface of mercury. For the contrivance whereby this was effected, I must refer you to the *Philosophical Transactions*, as also for some observations made by the Bishop of Cloyne with it, when applied to the Dublin circle.

The process of reversion, however, being difficult in this construction of the instrument, the objection was obviated by placing its telescope perpendicular to the mercurial surface; and it is this form of the instrument for which your Council has decreed your gold medal. The description of it is given by Captain Kater in the *Philosophical Transactions* for 1828; as is also the *admirable* series of experiments under the sanction of which the instrument was offered to our notice.

Considered theoretically, its adaptation to the end for which it was designed admits of very little doubt; and it is to be regretted, that, from its discovery till the present time, no observations made by its use with large instruments have come to our knowledge — indeed, the only comparison instituted between it and the plumb-

* Vide Transactions of the American Philosophical Society, held at Philadelphia, for promoting useful knowledge, vol. ii. p. 181.

line (as far as I know) is that made by the Society's Lee circle, recently presented to us, in a memoir, by our foreign Secretary. His observations, however, are too scanty to justify any positive inference; nor does my experience with *small* instruments enable me to say whether, all circumstances considered, an accordance between the results closer than that found by Captain Smyth, namely, four seconds, was reasonably to be expected.

That the vertical collimator is more easily referred to than the plumb-line, there can be no doubt; and that in accuracy it must be at least equal to the spirit level, few, I think, will deny; it is to be hoped, therefore, that by its application to the twenty-five feet zenith micrometer, shortly to be erected at Greenwich by the illustrious Troughton, its right to supersede them altogether will at length be placed beyond dispute.

(*The President then, addressing Captain Kater, continued thus:*—)

Into your hands, Captain Kater, I have the honour to deliver this medal: you, sir, know full well, that opinions as to the relative capabilities of the plumb-line and the vertical floating collimator, to indicate the zenith points of our instruments, are not unanimous. But, sir, of the ingenuity which led you to the invention of the latter, and of its correctness in point of theory, there is but one opinion. You have rendered many services to science—may you contribute many more; and, with every one who hears me, most fervently do I hope, that you may live to see the vertical floating collimator regarded as necessary an appendage to every circular instrument, as is the telescope itself.

(*The President then resumed his address to the Members, as follows:*—)

The second medal of the Society has been voted by the Council to M. Damoiseau, for his Memoir upon the Theory of the Moon, and for his Lunar Tables.

Of all astronomical knowledge, that which concerns the moon is by far the most important. Visible, on an average, twenty-four days out of every month, her rapid motion relatively to the sun and fixed stars, long since pointed out her observed distances from the one or the other, as the most effectual means of discovering the longitude.

The instrumental means were soon furnished by British ingenuity; the quadrant of Hadley was manageable on ship-board, and the only obstacle to the determination of a ship's longitude at sea, by the observed distances of the moon from the sun or certain well-known stars, was presented by the errors of the lunar tables. To obviate this, rewards to a very considerable amount were offered for the amelioration of the tables by different governments; and on the discovery of the laws of gravitation by the illustrious Newton, it was fondly hoped that all difficulties would vanish. Halley, however, soon found that the places assigned to the moon by the

Newtonian tables but very imperfectly represented the observed places; and, impressed with the idea that the errors were periodical, he hoped, by observations of the moon, continued through one revolution of her nodes, to supply the necessary corrections for the future. In this, however, he was unfortunately mistaken; and the incongruity found between theory and observation was so considerable, as to induce in some minds a doubt even as to the accuracy of the Newtonian theory of attraction. Little was done, after the death of Newton, towards improving the theory of the moon, till the subject was taken up by Clairaut, Euler, and D'Alembert; but the tables of these profound geometers were but little, if at all, used.

In 1755, Mayer sent a copy of his tables, founded on the theory of Euler, to the British government; the co-efficients of his equations being deduced from his own and Bradley's observations. In these the errors of the tables, which, in the time of Newton, extended to six minutes, were now reduced to one; and Mayer's representatives received from the British government the parliamentary reward to which their deceased friend was so well entitled.

Subsequently these tables were improved by Mason from Maskelyne's observations; and, more recently, Bouvard, Burg, and Burckhardt, by availing themselves of the profound investigations of the illustrious La Place, gave to the lunar tables a perfection which, but a few years before, the most sanguine supporters of Newton had scarcely ventured to anticipate.

But in these tables theory and observation were combined. Feeling, however, that the lunar theory *now* needed not the adventitious aid of observations, M. Damoiseau undertook the formation of new tables. Carrying the approximations beyond what had been hitherto attempted — neglecting no equations, however trifling in their numerical value, he has placed before the public, tables far more extensive than any of his predecessors. They exhibit an extraordinary effort of human labour, and that of the highest order — they represent the lunar motions with greater precision than any tables previously constructed — they are to seamen an invaluable treasure, and entitle M. Damoiseau to be regarded as a benefactor to mankind.

(*The President then, addressing Captain Smyth, said:*—)

Captain Smyth,—Transmit this medal to M. Damoiseau; assure him of the high value with which we regard his Memoir and Lunar Tables; and express to him our regret, that, exclusive of our gratitude, the medal of the Royal Astronomical Society is the only return we can make for the services he has rendered to us and to our country.

The Meeting then proceeded to the election of the Council for the ensuing year, when the following Members were elected, viz.

President: John Brinkley, D.D. *Lord Bishop of Cloyne.*— *Vice-Presidents:* Francis Baily, Esq. F.R.S. L.S. & G.S. and

M.R.I.A.; J. F. W. Herschel, Esq. M.A. F.R.S. L. & E. F.G.S. & M.R.I.A.; Rev. William Pearson, LL.D. & F.R.S.; Edward Troughton, Esq. F.R.S. L. & E.—*Treasurer:* John Lee, Esq. LL.D. —*Secretaries:* Augustus De Morgan, Esq. *Prof. Math. University of London;* John Wrottesley, Esq. M.A.—*Foreign Secretary:* Captain W. H. Smyth, R.N. F.R.S. & A.S.—*Council:* George Biddell Airy, Esq. M.A. *Plumian Prof. Ast. University of Cambridge;* Hon. Lord Ashley, M.P.; Charles Babbage, Esq. M.A. F.R.S. *Lucasian Prof. Math. University of Cambridge;* Peter Barlow, Esq. F.R.S.; Captain F. Beaufort, R.N. F.R.S.; Davies Gilbert, Esq. M.P. V.P.R.S. F.L.S. & G.S.; John William Lubbock, Esq. M.A. V.P. & *Treas.* R.S.; Edward Riddle, Esq.; Sir James South, F.R.S. L. & E. F.L.S. & M.R.I.A.; Lieutenant William S. Stratford, R.N.

LONDON:—J. MOYES, TOOK'S COURT, CHANCERY LANE.